ELEMENTAL ANALYSIS ON PTEROCARPUS MILDBREADII (OHA)SEED

PRESENTED

BY

EGECHI AMARACHI FRANCA

BC/2009/252

BEING A PROJECT RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY,CARITAS UNIVERSITY IN

AUGUST,2013

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BEING A PROJECT RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY,CARITAS UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE(B.Sc.)IN BIOCHEMISTRY

SUPERVISOR: MR. UGWUDIKE

AUGUST,2013

APPROVAL PAGE

THIS PROJECT WORK HAS BEEN APPROVED AS MEETING THE REQUIREMENT OF THE DEPARTMENT OF BIOCHEMISTRY, CARITAS UNIVERSITY,AMORJI-NIKE,EMENE-ENUGU FOR THE AWARD OF DEGREE(B.Sc.)

……. …….

MR.UGWUDIKE,P.O. DATE

(PROJECT SUPERVISOR)

……. …….

MR.EZENWALI,M. DATE

HEAD OF DEPARTMENT

……. …….

EXTERNAL SUPERVISOR DATE

DEDICATION

This project is dedicated to God, Almighty, who continues to provide new ideas in improving human health, to Blessed Virgin Mary, who continues to intercede for her children, and to the researchers who have made themselves available to save humanity.

ACKNOWLEDGEMENT

First and foremost, I will like to ascribe all glory and honor to God, the beginning and the end, who began this work with me, strengthened and finished well with me. He made it all possible. Thank you Jesus.

And with sincere appreciation, I thank my Project Supervisor , Mr Ugwudike, P.O; who with wisdom attended to the success of this project. Sir, God will favor you above all things. Thank you sir.

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labour daddy and mummy. Also, to my siblings, Chibuzo, Chizoba, Obinna, Echee and Mr. Ogechi,I love you all.

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A million thanks to you Chigozie Anosike,Wisdom,other friends,uncles, and numerous friends,I really appreciate your aid and pray for God's blessings to come upon you. Amen.

And to all I cannot mention and did not remember, God will never forget you. Thanks.

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ABSTRACT

Elemental analysis is the qualitative detection and quantitative determination of chemical elements(atoms,ions)in a sample(Fritz Pregl 1923). To detect an

element, one should fix an appearance of an analytical signal. The formation of precipitate or characteristic crystals, colour change, an isolation of gaseous products, an appearance of a definite lines in spectrum, luminescence, etc. To determine elements quantity, it is necessary to measure a value of an analytical signal; a precipitate mass, intensity of a current, solution absorption, spectrum line, luminescence or radioactivity, a reaction rate and so on.(www.intechopen.com).

This study was undertaken to analse the elements present in grounded Pterocarpus mildbreadii (Oha seed) using Atomic Absorption Spectrometer(AAS MODEL-AA320N).The seed was found to contain these essential macro minerals/elements sodium(Na),Potassium(K),calcium(Ca),magnesium(Mg),and the trace elements iron(Fe),copper(Cu),zinc(Zn), and selenium(Se)(Duffus,2002).

The study established that Pterocarpus mildbreadii(oha seed) does not contain manganese and has high content of potassium which is necessary for good health.

CHAPTER ONE

1.1 INTRODUCTION, AIMS AND OBJECTIVES

A seed or mature ovule is a miniature plant with a protective cover in a suspended state of development. Most seeds contain a built-in food supply called endosperm, orchid is an exception. The endosperm can be made up of proteins, carbohydrates and fats.

Seed can also be defined as a small embryonic plant enclosed in a covering called the seed coat, usually with some stored food. It is the product of the ripened ovule of gymnosperm and angiosperm plants which occurs after fertilization and some growth within the mother plant(Wikipedia).Seed protects a plant embryo so that it can grow into a new plant. Many seeds are edible, such as sunflower seeds, tomato seeds, corn and peas.

Seeds contain three distinct structures. The inside of a seed contains an embryo, which is a baby plant with a shoot and a tiny root. The two halves of a seed are stored food that provides the nourishment necessary for seeds to germinate, or begin growing. Surrounding the seed is a hard, tough seed coat, which protects the seed during dormancy(Anville 2007).

Most seeds contain a built-in food supply called endosperm. The endosperm can be made up of proteins, carbohydrates and fats. Seeds also contain anti-nutrients in

their seed coat. These anti-nutrients includes phytin, lectin, trypsin inhibitor activity, tannin and cyanide. In addition, they also contain minerals such as sodium, potassium,calcium,magnesium,phosphorus,zinc,manganese,iron,selenium and copper.(Balogun 2000)

Oilseeds are energy dense foods; for example, sesame seeds provide 600kcal or 2470kj/1000g.Although oilseeds contain protein(|14-32g/100g)and carbohydrate(ranging from less than 1g/100g to more than 34g/100g),most of the food energy they provide is as fat(which provides 9kcal or 37kj/g).Oilseeds vary widely in their fatty acid composition but tend to be rich in MUFA(e.g peanut)r PUFA(e.g sunflower seeds).Some seed oils contain significant amounts of EFA, ALNA, an n-3 fatty acid, and linoleic acid(LA),an n-6 fatty acid. from these two fatty acids, the body can make all the fatty acids it needs. From LA, arachidonic acid can be produced, and from ALNA the long chain n-3 eicosapentaenoic acid(EPA)and docosahexanoic acid(DHA)can be made.(BNF 1999).

Generally, whole oilseeds are a source of fibre, phosphorus, iron and magnesium; many oilseeds are a source of vitamin E(an antioxidant),niacin and folate. Whole oilseeds also contain phytoestrogens, a group of substances including lignans and isoflavones. Phytoestrogens have a structure similar to the oestrogen hormone oestradiol and can bind to oestrogen receptors.Phytoestrogens may provide a protective effect against coronary heart disease as they have been shown to have a

lowering effect on blood cholesterol.Additionally,some phytoestrogens may have antioxidant properties(Goldberg 2003).

In Britain, oilseeds are usually consumed, following processing,as oils and margarines. The fatty acid composition of oils produced from oilseeds varies widely. Vegetable oils do not contain the same levels of macronutrients, vitamins and minerals as whole oilseeds. In fact, apart from fat itself, vitamin E is the only nutrient present in appreciable amounts. Vegetable oils do, however, contain a range of phytochemicals, e.g they are the main source of natural plant sterols in the diet. Plant sterols have a structure similar to cholesterol and hence reduce cholesterol absorption, therefore reducing the circulating levels of total and low density lipoprotein(LDL)cholesterol. Plant sterols can be present as free or esterified forms and the proportions vary, e.g free sterols dominate in soybean,olive and sunflower oil,while in rapeseed and corn oil, free sterols account for only 30% of the plant sterols.Refining vegetable oils decreases the content of sterols(from 10-70% depending on the oil and processing conditions used),thus decreasing their potential to lower serum cholesterol(Goldberg 2003).

1.2 AIM OF STUDY

To determine the elements present in grinded oha seed(Pterocarpus mildbreadii)

1.3 RESEARCH OBJECTIVE;

This study was primarily designed to use grinded oha seed(Pterocarpus mildbreadii) extract for elemental analysis.

CHAPTER TWO

LITERATURE REVIEW

2.1 ELEMENTAL ANALYSIS

Elemental analysis is the qualitative detection and quantitative determination of chemical elements(atoms, ions)in a sample(Fritz Pregl 1923).To detect an element, one should fix an appearance of an analytical signal, the formation of precipitate or characteristic crystals, color change, an isolation of gaseous products, an appearance of a definite lines in spectrum, luminescence ,etc. To determine elements quantity, it is necessary to measure a value of an analytical signal: a precipitate mass, intensity of a current, solution absorption, spectrum line, luminescence or radioactivity, a reaction rate and so on. The content of an element is calculated on the base of a functional dependence of the analytical signal value(AS)on a mass or concentration of this element(AS=F©),which is established by calculations or experiments(Mazor L 1986).To obtain the analytical signal, chemical reactions of different types(acid-base, oxidation-reduction, complex formation),various processes(eg. precipitation)as well as different chemical, physical, biological properties of elements themselves or product of their reactions, are used. Methods for the detection and determination of elements are divided into chemical, physical, biological. The most important characteristics of these methods are the detection limit, sensitivity, selectivity,

precision, rapidity and price of analysis. At present, elements are mostly detected with the help of physical methods, which are based on physical phenomena or processes eg. an interaction of elements with an energetic current. Among such methods is the method of atomic emission spectroscopy(AES),based on a thermal excitation of atoms of free elements and registration of the optic spectrum of excited atoms emission (Kellner R.et al. 1998).

MACRO ELEMENTS

POTASSIUM

Potassium is a soft, silvery alkali metal.

Atomic number: 19

Potassium symbol: K

Potassium atomic weight: 39.0983

Discovery: Sir Humphrey Davy 1807(England)

Potassium word Origin: English potash pot ashes; Latin kalium, Arabic qali: alkali

Isotopes: There are 17 isotopes of potassium. Natural potassium is composed of three isotopes, including potassium-40(0.0118%),a radioactive isotope with a half life of 1.28 * 109years.

Potassium properties: Melting point is 63.25^0c, bioling point is 760^0c,specific gravity is 0.862(20^0c),with a valence of 1.Potassium is one of the most reactive and electropositive of metals. The only metal that is lighter than potassium is lithium. The silvery white metal is soft(easily cut with a knife).The metal must be stored in a mineral oil, such as kerosene, as it oxidizes rapidly in air and catches fire spontaneously when exposed to water. Its decomposition in water evolves hydrogen. Potassium and its salts will color flames voilet.(Lange's Handbook of Chemistry 1952).

Uses: Potash is in high demand as a fertilizer. Potassium, found in most soils, is an element that is essential for plant growth. An alloy of potassium is used as a heat transfer medium. Potassium salts have many commercial uses.

Sources: Potassium is the 7^{th} most abundant element on earth, making up 2.4% of the earth's crust, by weight. Potassium is not found free in nature. Potassium was the first metal isolated by electrolysis(Davy,1807,from caustic potash KOH).Thermal methods(reduction of potassium compounds with

C,Si,Na,CaC2)are also used to produce potassium.(Lange's Handbook of Chemistry 1952).

Potassium in the body

Potassium is important for membrane function, nerve impulses, and muscle contractions. Potassium cations are found in cellular cytoplasm. The electrolyte helps to attract oxygen and remove toxins from the tissues. Potassium is found in muscles and nerves as ions. It makes up about 0.4% of body fluid. It is the principal cation of intracellular fluid(ICF).(Crescent Chemical Company(2001).

Bodily function facilitated:

-heartbeat

-muscle contraction

-proteosynthesis

-osmotic equilibrium

-utilization of sacharides.

SODIUM

Sodium atomic number: 11

Sodium symbol: Na

Sodium atomic weight: 22.989768

Sodium word origin: English soda and Medieval Latin sodanium: headache remedy; Latin natrium: sodium carbonate

Isotopes: Eighteen isotopes of sodium are known. Only one isotope is stable:Na-23.

Properties: Sodium has a melting point of 97.81+/-0.03^{0}c,boiling point of 882.9^{0}c, specific gravity of 0.971(20^{0}c), and a valence of 1.Sodium is a bright, silvery metal, it is soft and highly reactive. Sodium floats in water, which decomposes it to evolve hydrogen and form the hydroxide. Sodium may ignite spontaneously on water. It does not usually ignite in air at temperatures below 115^{0}c.(International Atomic Energy Agency ENSDF database Oct.2010).

Uses: Sodium chloride is important for animal nutrition. Sodium compounds are used in the glass, soap, paper, textile, chemical, petroleum, and metal industries. Metallic sodium is used in manufacturing of sodium peroxide, sodium cyanide, sodamide, and sodium hydride. Sodium is used in preparing tetraethyl lead. It is used in the reduction of organic esters and preparation of organic compounds. Sodium metal may be used to improve the structure of some alloys, to descale metals, and to purify molten metal's. Sodium, as well as NaK, an alloy of sodium

with potassium, are important heat transfer agents.(Los Alamos National Laboratory 2001).

Sources: Sodium is relatively abundant in the sun and other stars. The D lines of sodium are prominent in the solar spectrum. Sodium is the sixth most abundant element on earth comprising approximately 2.6% of the earth's crust. Sodium is the most abundant of the alkali metals. The most common sodium compound is sodium chloride(salt).Sodium occurs in many minerals, such as cryolite, soda niter, zeolite, amphibole, and sodalite. Sodium is not found free in nature. It is obtained commercially by the electrolysis of dry fused sodium chloride.(Lange's Handbook of Chemistry 1952).

Occurrence in human body

Na^+ is principle cation of extracellular fluid (ECF)

In serum:135-144mmol/1,ICF:37mmol/1.

Bodily function facilitated:

-acid-base equilibrium

-normal cellular fluid level

-proper muscle contraction.

MAGNESIUM

Magnesium symbol: Mg

Atomic number: 12

Atomic weight: 24.3050(6)

Word origin: Magnesia,a district in Thessaly, Greece

Properties: Magnesium has a melting point of 648.8^0c,boiling point of 1090^0c,specific gravity of 1.738(20^0c),and valence of 2.Magnesium metal is light(one-third lighter than aluminium),silvery-white, and relatively tough. The metal tarnishes slightly in air. Finely divided magnesium ignites upon heating in air, burning with a bright white flame.(Lange's Handbook of Chemistry 1952).

Uses: Magnesium is used in pyrotechnic and incendiary devices. It is alloyed with other metals to make them lighter and more easily welded, with applications in the aerospace industry. Magnesium is added to many propellents. It is used as a reducing agent in the preparation of uranium and other metals that are purified from their salts. Magnesite is used in refactories. Magnesium hydroxide(milk of magnesia),sulfate(epsom salts),chloride and citrate are used in medicine. Magnesium is essential for plant and animal nutrition. Chlorophyll is a magnesium-centered porphyrin.(CRC Handbook of Chemistry &Physics 18^{th} Ed.).

Sources: Magnesium is the 8th most abundant element in the earth's crust. While it is not found free in nature, it is available in minerals including magnesite and dolomite. The metal may be obtained by electrolysis of fused magnesium chloride derived from brines and seawater.(Lange's Handbook of Chemistry 1952))

Occurrence in human body

Cation of intracellular fluid(99% of Mg is intracellular, one half is binding in proteins and at a crystals of hydroxyapatite in bones. One half is in the muscles, liver and central nervous system).

In plasma:5-60% is ionised,30% is binding to protein, the rest is complex with anions of acids.

Magnesium participates in all biochemical and physiological processes because of their ability to activate(together with zinc)approximately 230 enzymes.

Bodily function facilitated:

-acid/alkaline balance

-blood sugar metabolism(energy)

-calcium metabolism.

CALCIUM

Atomic number: 20

Symbol: Ca

Atomic weight: 40.078

Calcium word origin: Latin calx, calcis: lime

Calcium properties: The melting point of calcium is 839+/-2^{0}c,boiling point is 1484^{0}c,specific gravity is 1.55(20^{0}c).Calcium is a silvery white, soft alkaline earth metal. Although none of the alkaline earths occur free in nature, calcium compounds are abundant.(Lange's Handbook of Chemistry 1952).

Uses: Calcium is essential for human nutrition. Animals skeleton get their rigidity normally from calcium phosphate. The eggs of birds and shells of molluscs are comprised of calcium carbonate. Calcium is also necessary for plant growth. Calcium is used as a reducing agent when preparing metals from their halogen and oxygen compounds; as a reagent in purification of inert gases; to fix atmospheric nitrogen; as a scavenger and decarbonizer in metallurgy; and for making alloys. Calcium compounds are used in making lime, bricks, cement, glass, paint, paper, sugar, glazes, as well as for many other purposes.(International Atomic Energy Agency ENSDF database Oct 2010).

Sources: The Romans prepared lime (called calx)in the first century, but the metal was not discovered until 1808.Berzelius and Pointin prepared calcium amalgam by electrolyzing lime in mercury. Davy isolated the impure metal. The metal may be prepared by electrolysis of $CaCl_2$ at a temperature slightly above its melting point. Calcium is the fifth most abundant element in the earth's crust, making up 3.22% of the earth, air, and oceans. Natural forms of calcium include limestone($CaCO_3$),gypsum($CaSO_4.2H_2O$),and fluorite(CaF_2).Apatite is the fluorophosphates or chlorophosphate of calcium.(Annie Helmenstine 2001).

Occurrence in human body:

Extracellular cation. Almost all of calcium is in the bones and teeth in form of hydroxyapatite ~ $Ca_{10}(PO_4)_6(OH)_2$.

Plasma: 2,25 – 2,75 mmol/l

There are three forms of Ca in plasma:

- ionised (cca 50%)
- protein- bond (35 – 40%)
- as complex with anions of acids (5 – 10%) (citrate)

Bodily function facilitated:

- bone/tooth formation
- blood clotting
- heart rhythm

- nerve transmission

-muscle growth and contraction.

TRACE ELEMENTS

ZINC

Atomic number: 30

Symbol: Zn

Atomic weight: 65.39

Word origin: German zinke: of obscure origin, probably german for tine. Zinc metal crystals are sharp and pointed. It could also be attributed to the German word ‘zin’ meaning tin.

Properties: Zinc has a melting point of 419.58^{0}c,boiling point of 907^{0}c,specific gravity of 7.133(25^{0}c),with a valence of 2.Zinc is a lustrous blue-white metal. It is brittle at low temperatures, but becomes malleable at 100-150^{0}c.It is a fair electrical conductor. Zinc burns in air at high red heat, evolving white clouds of zinc oxide.(International Atomic Energy Agency ENSDF database Oct.2010).

Uses: Zinc is used to form numerous alloys, including brass, bronze, nickel, silver, soft solder, Geman silver, spring brass and aluminium solder. Zinc is used to make

die castings for use in the electrical, automotive and hardway industries. The alloy prestal, consisting of 78%zinc and 22%aluminium,is nearly as strong as steel yet exhibits superplasticity. Zinc is used to galvanize other metals to prevent corrosion. Zinc oxide is used in paints, rubbers, cosmetics, plastics, inks, soap, batteries, pharmaceuticals, and many other products. Other zinc compounds are also widely used, such as zinc sulfide(luminous dials and fluorescent lights)and ZrZn2(ferromagnetic materials)(CRC Handbook of chemistry and physics 18th Ed.)

Sources:The primary ores of zinc are sphalerite or blende(zinc sulfide), smithsonite(zinc carbonate),calamine(zinc silicate),and franklinite(zinc,iron and manganese oxides).An old method of producing zinc was by reducing calamine with charcoal. More recently, it has been obtained by roasting the ores to form zinc oxide and then reducing the oxide with carbon or coal, followed by distillation of the metal.

Occurrence in human body:

Zinc is namely intracellular element. (60% is in muscles, 30% in bones).

Zinc is component of some enzymes (carbonate anhydrase, lactate dehydrogenase, alcohol dehydrogenase and superoxide dismutase).

Zinc is an activator of about 230 enzymes.

Bodily function facilitated:

- carbohydrate digestion

- prostate gland function

- reproductive organ growth and development

-phosphorus and protein metabolism.

COPPER

Atomic number: 29

Symbol: Cu

Atomic weight: 63.546

Word origin: Latin cuprum: from the isle of cyprus, which is famed for its copper mines.

Properties: Copper has a melting point of 1083.4=/-0.2^{0}c,boiling point of 2567^{0}c,specific gravity of 8.96(20^{0}c),with a valence of 1 or 2.Copper is reddish colored and takes a bright metallic luster. It is malleable, ductile, and a good conductor of electricity and heat. It is second only to silver as an electrical conductor.(Lange's Handbook of Chemistry 1952).

Uses: Copper is widely used in the electrical industry. In addition to many other uses, copper is used in plumbing and for cookware. Brass and bronze are two

important copper alloys. Copper compounds are toxic to invertebrates and are used as algicides and pesticides. Copper compounds are used in analytical chemistry, as in the use of Fehling's solution to test for sugar. American coins contain copper.(Los Almos National Laboratory 2001).

Sources:

Sometimes copper appears in its native state. It is found in many minerals, including malachite, cuprite, bornite, azurite, and chalcopyrite. Copper ore deposits are known in North America, South America, and Africa. Copper is obtained by smelting, leaching, and electrolysis of the copper sulfides, oxides, and carbonates. Copper is commercially available at a purity of 99.999+%.

Occurrence in human body:

It is component of some oxidoreductases (e.g. cytochromoxidase c, lysyloxidase, Superoxide dismutase) and plasmatic protein - ceruloplasmine (oxidase).

Bodily function facilitated:

- synthesis of collagen
- bone formation
- healing processes of body

-hemoglobin and red blood cell formation.

MANGANESE

Atomic number: 25

Symbol: Mn

Atomic weight: 54.938045

Word origin: Latin magnes: magnet, referring to the magnetic properties of pyrolusite; italian manganese: corrupt form of magnesia.

Properties: Manganese has a boiling point of 1244=/-3^{0}c,boiling point of 1962^{0}c,specific gravity of 7.21 to 7.44(depending on the allotropic form),and valence of 1,2,3,4,6,or 7.Ordinary manganese is a hard and brittle gray-white metal. It is chemically reactive and slowly decomposes cold water. Manganese metal is ferromagnetic (only) after special treatment. There are four allotropic forms of manganese. The alpha forms is stable at normal temperatures. The gamma form changes to the alpha form at ordinary temperature. In contrast to the alpha form, the gamma form is soft, flexible and easily cut.(Los Alamos National Laboratory 2001).

Uses: Manganese is an important alloying agent. It is added to improve the strenghth, toughness, stiffness, hardness, wear resistance, and hardenability of steels. Together with aluminium and antimony, especially in the presence of

copper, it forms highly ferromagnetic alloys. Manganese dioxide is used as a depolarizer in dry cells and as a decolorizing agent for glass that has been colored green due to iron impurities. The dioxide is also used in drying black paints and in the preparation of oxygen and chlorine. Manganese colors glass an amethyst color and is the coloring agent in natural amethyst. The permanganate is used as an oxidizing agent and is useful for qualitative analysis and in medicine. Manganese is an important trace element in nutrition, although exposure to the element is toxic in higher quantities.(Lange's Handbook of Chemistry 1952).

Sources:In 1774,Gahn isolated manganese by reducing its dioxide with carbon. The metal may also be obtained by electrolysis or by reducing the oxide with sodium,magnesium or aluminium.Manganese-containing minerals are widely distributed.Pyrolusite(MnO_2)and rhodochrosite($MnCO_3$)are among the most common of these minerals.

Occurrence in human body:

It is component of enzyme xanthine oxidase and activator of many enzymes.

Bodily function facilitated:

- synthesis of glycoproteins
- releasing of Fe from ferritine
- sex hormone production

- tissue respiration.

IRON

Atomic number: 26

Symbol: Fe

Atomic weight: 55.847

Word orin: Latin ferrum; Anglo-Saxon iron.

Properties: The melting point of iron is 1535^0c, boiling point is 2750^0c,specific gravity is 7.874(20^0c),with a valence of 2,3,4,or 6.Pure iron is chemically reactive and corrodes rapidly, especially in moist air or at elevated temperatures. Four allotropic forms of, or ferrites are known: a, b, g, and d, with transition points at 770,928,and 1530^0c.The a form is magnetic, but when iron is transformed into the b form, the magnetism disappears, although the lattice remains unchanged.(International Atomic Energy Agency ENSDF database Oct.2010).

Uses: Iron is vital to plant and animal life. In humans, it appears in the hemoglobin molecule. Iron metal is usually alloyed with other metals and carbon for commercial uses. Pig iron is an alloy containing about 3-5%carbon,with varying quantities of Si, S, P, and Mn. Pig iron is brittle, hard and fairly fusible and is used to produce other iron alloys, including steel. Wrought iron, less fusible than pig

iron, has a fibrous structure. Carbon steel is an iron alloy with carbon and small amounts of S, Si, Mn, and P. Alloy steels are carbon steels that contain additives such as chromium, nickel, vanadium, etc. Iron is the least expensive, most abundant and most used of all metals.(Marie Helmenstine 2001).

Sources: Iron is a relatively abundant element in the universe. The sun and many types of stars contain iron in quantity. Iron is found native in a class of meteorites called siderites and it is a minor constituent of the other two classes of meteorites. The earth's core is thought to be composed mainly of iron, with about 10%occluded hydrogen. Iron is the fourth most abundant element in the earth's crust. The most common iron ore is hematite(Fe2O3),from which iron metal is obtained by reduction with carbon. Iron is also found in minerals such as taconite and magnetite, which is commonly seen as black sands along beaches and stream banks.

Occurrence in human body:

Iron(Fe) is in molecule of hemoglobin and myoglobin. Heme is component of cytochromes.

In organism, Fe is stored in ferritin. Fe is transported with transferin in blood.

Bodily function facilitated:

- biological oxidation (hemoglobin and myoglobin – transport of O2, cytochroms

–transport of electrons)

- hemoglobin production.

SELENIUM

Atomic number: 34

Symbol: Se

Atomic weight: 78.96

Word origin: Greek Selene: moon.

Properties: Selenium has an atomic radius of 117pm,melting point of 220.5^0c,boiling point of 685^0c,with oxidation states of 6,4,and -2.Selenium is a member of the sulfur group of non-metallic elements and is similar to this elements in terms of its forms and compounds. Selenium exhibits photovoltaic action, where light is converted directly into electricity, and photoconductve action, where electrical resistance decreases with increased illumination. Selenium exists in several forms, but is usually prepared with an amorphous or crystalline structure. Amorphous selenium is either red(powder form)or black(vitreous form).Crystalline monoclinic selenium is deep red; crystalline hexagonal selenium, the most stable variety, is gray with a metallic luster. Elemental selenium is fairly non-toxic,

resembling arsenic in their physiological reactions.(Los Alamos National Laboratory 2001).

Uses: Selenium is used in xerography to copy documents and on photographic toner. It is used in the glass industry to make ruby-red colored glasses and enamels and to decolorise glass. It is used in photocells and light meters. Because it can convert AC electricity to DC, it is widely used in rectifiers. Selenium is a p-type semiconductor below its melting point, which leads to many solid-state and electronics applications. Selenium is also used as an additive to stainless steel.(CRC handbook of Chemistry & Physics,18th Ed.)

Sources: Selenium occurs in the minerals crooksite and clausthalite. It has been prepared from flue dusts from processing copper sulfide ores, but the anode metal from electrolytic copper refineries is a more common source of selenium. Selenium may be recovered by roasting the mud with soda or sulfuric acid, or by smelting with soda and niter:

$Cu_2Se + Na_2CO_3 + 2O_2$---$2CuO + Na_2SeO_3 + CO_2$.

The selenite Na_2SeO_3 is acidified with sulphuric acid. Tellurites precipitate out of solution, leaving selenous acid,H_2SeO_3n.Selenium is liberated from selenous acid by SO_2.

$H_2SeO_3 + 2SO_2 + H_2O$---$Se + 2H_2SO_4$.

Occurrence in human body:

It is component of some enzymes e.g. glutathionperoxidase

Bodily function facilitated:

- antioxidant

- synthesis of prostaglandins.

2.2 TRACE ELEMENTS AS CATALYSTS

Carbonic anhydrase

(Carbonic anhydrase) is responsible for the rapid removal of carbon dioxide from the blood. […the fact that zinc is a constituent is confirmed.] In its absence the carbon dioxide would accumulate and would slow up the entire respiratory process, because of the accumulation of 'waste' products….green plants need an efficient system to absorb carbon dioxide from the air in order to carry out photosynthesis…But carbon dioxide is present in very small amounts in the air; usually only about 0.03 per cent.

[Note that young leaves have an adequate supplies of zinc, even if grown in zinc- deficient substrate. These are derived from reserves in the seeds. (This is why younger plants often start out looking healthy and as they mature a bit, they start to die.)The general picture of zinc deficiency coupled with decreased carbonic anhydrase activity is quite clear.

Oxidases

The oxidases are a group of enzymes which promote oxidative processes. Of which there are a large number in living matter. They transfer hydrogen or electrons directly to oxygen as a rule, and are of great importance, especially in respiratory processes, where they are responsible for the ultimate oxidation of the organic matter being broken down.Of these the cytochrome oxidases, many of which contain *iron* in their prosthetic groups,have been known for a long time.

Non-enzymatic catalysis by trace-element ions

Metal ions can function as catalysts on their own, without being associated with enzyme functions.

Krebs showed that aluminum (Al+++), iron (Fe++ and Fe+++) and copper (Cu++) are active in decarboxylating oxaloacetic acid, an important constituent of the respiratory cycle.

2.3 BIOLOGICAL FUNCTIONS OF METALS,SOURCES AND DEFICIENCY

 Sodium Source: The main source of sodium is NaCl salt in cooking in addition to salted foods. The content of sodium is high in bread, cheese, clams, carrots. cauliflower, eggs, milk, nuts, spinach. Daily Requirement : 5 to 10 g. of Nacl for

adult. Na+ is the major cation of blood, plasma of vertebrates while K+ is major cation of the cytoplasm which is present in cells.

Function of Sodium : – It maintains osmotic pressure of the body. – It plays important role in absorption of glucose, amino acids and galactose. – It is associated with chloride and bicarbonate in regulation of acid base balance.

Deficiency of Sodium : – Due to high environmental temperature extreme sweating may cause loss of sodium ion. This is regarded as muscular cramps of the abdomen, headaches. – High intake of table salt causes high blood pressure.

 Potassium Source and Requirement – – High content of K is present in chicken, beef liver, bananas. Juice of orange , pineapples and potatoes, yams. – Intake about 4 g/d.

Function : – It is principal cation of Intra cellular fluid i.e. Cytoplasm of cell. Increase the activity of muscles especially cardiac muscles. – Maintain acid base balance and osmotic pressure of body. – It increases activity of glycolytic enzyme, pyruvate kinase. – It stops blood coagulation. It regulates heart beat also. – It plays important role in synthesis of ribosomes.

Deficiency : – Depression and low activeness of cardiac and nervous system. – Causes muscular weakness (Cramping of muscles).

 Calcium Source and Requirement – – It is present in milk, eggs,beans, nuts, figs cabbage, cauliflower and aspergus. – About 800 mg daily is needed for men and women above 18 while people below 18th age, require 1 – 1.2 gm/daily.

Function : – It is major constituent of bones and teeth. About 90% of the body calcium is in the skeleton, where it is maintained as deposits of calcium phosphate, a soft fibrous matrix. – Ionized calcium is of great importance in blood coagulation. – It maintains the normal excitability of heart also.

Deficiency : – Low concentration of calcium causes irritation. – Low concentration of calcium causes weakness of bones in children. (i.e. Rickets) – It also causes Osteoporosis in adults.

 Iron Source – – The best dietary sources of iron are organ such as meats, liver, heart, other sources are egg yolk,wheats, nuts, beans, spinach and molasses, apples , bananas.Requirement – – Children – (1-8 yrs) 15 mg – Adult – 10 mg daily – Female - 18 mg (During pregnancy and Lactation) – After 51 years age – 10 mg daily.

 Function – – It is required for tissue growth and blood hemoglobin. – The role of iron in body is almost confined to the pressure of cellular respiration. – Iron porphyrin (i.e. Heme) groups are essential component of hemoglobin and myoglobin which is responsible for intake of oxygen and circulation of oxygen then also removal of CO_2.

Deficiency: – Especially in women after the age of 45causes black dot spot on skins. It is due to low concentration of H.b. – Fe deficiency leads to anemia type of hypo chronics and microcytics type. Deficiency of Fe causes the bone marrow to produce small cells (Microcytics) with less than optimum hemoglobin content (Hypo chromic) – Low concentration of Fe causes slower rate of formation of RBC. It develop the disease with Pale Skin. – Its deficiency causes low energy palpitation and shortness of breath. – All these problems can be cured by supply of Ferous Salts.

 Copper Source – Nuts, liver, fish, cow milk. Requirement – – Adult 2.5 mg/daily – Infant and children – 0.5 mg.

Function – – It is essential constituents of many proteins, metalloenzyme and some naturally occurring pigments. – It is also essential for formation of hemoglobin, normal bone formation. – The hemoglobin is a copper protein complex which is present in blood of certain invertebrates and function like hemoglobin.

Deficiency : – Deficiency effect of copper has never been positively demonstrated but it has been suspected in case of spurs or in nephrosis.

 Magnesium Source – – It is present in Cocoa, various nuts, soyabean and sea foods. – It is also present in beans, peas in small quantity. Requirement – – About 300 mg/daily for adult women and 350 mg/daily for adult men.

Function : – The body contains about 21 mg of magnesium, 70% combined with calcium and phosphorus is complex salt of bones. – Mg++ ion is one of essential cation of soft tissue. – In muscles and other tissue intra cellular Mg++ ions probably functions as activators of phosphate group transfer enzyme.

Deficiency : – In case of mean loss, lead to neuro muscular disfuctioning (Hyper excitability)

 Zinc Source : – The main sources are meats, liver, eggs, sea foods, milk, whole grains.Requirement – – Adult – 15 mg/daily – Female – During pregnancy and lactation 10-12 mg/daily.

Function : – It is essential for normal growth. – It is essential for tissue repair and wound healing. – It is essential component of enzymes present in human body such as alcohol dehydrogenase, alkaline phosphatase and carbonic anhydrase. – It maintains normal concentration of Vitamin A in plasma. – The function of insulin is also regulated with zinc.

2.4 Pterocapus mildbreadii Harms: A case study for Elemental analysis.

The plant Pterocarpus mildbreaii(Rojo,J.P,1972)is God's gift to man. It's analysis shows that it contains calcium, sodium,

magnesium, potassium, zinc, copper, iron, manganese and selenium, with potassium being the highest(Notizbl. Bot. Gart. Berlin 8:152,1922).

Mineral elements Na, K, Ca & Mg have important roles in both the control of cardiac output and peripheral vascular resistance, the main determinants of blood pressure level(H.Karppanen,1991).The macro minerals have catalytic activity and help also to maintain good health eg. iron prevents anemia(Clemens 2006).

2.4.1 Systematic position of Pterocarpus mildbreadii (Oha seed)(Jacqquin,N.J,1763).

Dormain: Eukaryota

Subkingdom: Viridaeplantae

Phylum: Tracheophyta

Subphylum: Euphyllophytina

Class: Spermatopsida

Subclass: Rosidae

Superorder: Rosanae

Order: Fabales

Family: Leguminosae

Subfamily: Papilionoideae

Tribe: Dalbergieae

Genus: Pterocarpus

Specie: Mildbreadii-Harms

Botanical name: Pterocarpus mildbreadii Harms.

Other species in the genus ‘Pterocarpus’ include angolensis,dalbergiodes,macrocarpus,indicus,brenanii,orbiculatus DC,amazonum,albopubencens,acapulcensis,rotundifolius,santalinoides,soyauxii etc. They are similar in physical, and chemical characteristics and in their apllications. Some global common names ascribed to Pterocarpus mildbreadii Harms are African rosewood(English):aguaya(Ivory coast),Ohasji(iwu), Ora(Sierra Leone),Urube(Edo,Nigeria); madoobiyaa(Hausa,Nigeria); Oha ojii(Igbo, Nigeria).

2.4.2 General Characteristics of Leguminosae

Leguminosae (Fabaceae in the U.S.A)is an extremely diverse family. They are of the pea or bean family. (Polhill & Raven,1981).Legumes are used as crops, forages and green manures. They also synthesize a wide range of natural products such as flavours, drugs, poisons and dyes. The species within the family range from dwarf herbs of arctic and alpine vegetation to massive trees of tropical forest.

The principal unifying feature of the family is the fruit, a pod, technically known as a legume. The legume is modified in many ways to facilitate dispersal by animals, wind and water. The family is usually divided into three sub-families: Papilionoideae, Caesalpiniodeae and Mimosoideae.

In terms of economic importance, the leguminosae is the most important family in the Dicotyledonae(Haborne,19944).They are second only to grasses(cereals)in providing food crops for world agriculture. The seeds of legumes are rich in high quality protein, providing man with a high nutritional food resource. Many more legumes are local food plants. In addition to those legumes cultivated for human consumption many yield important fodders, green manures and forages e.g Lupinus(Lupin), Medicago(Alfalfa)and Trifolium(Clover).Legumes are also utilised for a variety of other purposes including timber, medicine, tannins and gums. Some legume trees yield valuable resins, used in varnishes, paints and lacquers eg copaifera and others are the source of dyes, e.g indigofera. Many legume species are characteristic of open and disturbed places and are thus well adapted to grow under poor conditions.

2.4.3 Geographical Distribution of Pterocarpus mildbreadii

Pterocarpus mildbreadii is found in Sierra Leone, Liberia, Cote d'ivire, Ghana, Benin, Nigeria, Cameroon, Equatorial Guinea, Gabon and the Usambara and Udzungwe mountains(Tanzania).Records for DR Congo are based on misidentification.

2.4.4 Properties

The leaves of Pterocarpus mildbreadii contain per 100g edible portion: water 85g,energy 237kj(57kcal),protein 3.8g,fat 0.8g,carbohydrate 8.2g,crude fibre 1.13g,calcium 72mg,magnesium 28mg,iron 4.7mg,and zinc 3.1mg(Akpanyung,E.O.,Udoh,A.P.&Akpan,E.J.,1995).Hydrogen cyanide and oxalate levels are high but not such that they pose a health danger for consumers. An ethanolic extract proved toxic to rats only after intraperitoneal administration.

2.4.5 BOTANY

Medium-sized to large tree up to 35m tall, with smooth, grey or pale brown bark, exuding a red gum when cut,and small, rounded crown. Leaves alternate, imparipinnate, up to 35cm long; stipules lanceolate, up to 1cm long, caduceus; leaflets(5-)7-15,alternate,elliptical-oblong to ovate,6-14cm *3-7cm,base rounded to cuneate, apex abruptly acuminate. Inflorescence a raceme or little -branched panicle 5-15cm long. Flowers bisexual,papilionaceous,5-merous;calyx 5-8mm long,densely covered with short hairs on the lobes inside and near lobes inside and near lobe margins outside; corolla golden-yellow,1-1.5cm long. Fruit, an obovate-orbicular pod 10-12cm long, with very broad membranous wing, style base lateral,1(-2)-seeded.

Pterocarpus comprises about 60species,all primarily used for timber, have leaves that are used as vegetable as well. Pterocarpus mildbreadii grows fast and coppices well. Its root system is superficial; most roots are in the top 30cm of the soil. It has an intermittent pattern of leaf flushes. Flushes appear in the dry season when other leafy vegetables are scarce..When left for many years, it produces seeds.

2.4.6 ECOLOGY

Pterocarpus mildbreadii occurs in lowland rainforest, dry evergreen forest and riverine forest, up to 1250m altitude. In Tanzania it is restricted to altitudes of 300-600m.It is tolerant of acid soil.

2.4.7 MANAGEMENT/PROPAGATION

Pterocarpus mildbreadii leaves are collected from the wild, but frequently marketed. Attempts to domesticate it are being made. Propagation can be done by seed, budding or cuttings.

2.4.8 PROSPECTS

Pterocarpus mildbreadii is a nutritious vegetable but despite this is only exploited as such in Southern Nigeria. A better understanding of the variation in the species might help in the process of domestication. It is being tested in agroforestry systems.

2.4.9 USES

General:

Agri-horticulture: shade trees.

The wood is used as timber.

Bark:

Products: Exudations-gums, resins etc.

Leaf

Food: general.

CHAPTER THREE

MATERIALS AND METHODS

3.1 MATERIALS

3.1.1 EQUIPMENT/APPARATUS

The equipment/apparatus used for this research study includes:

Beakers

Conical flask

Filter paper

Grinder(Mill)

Weighing balance

Furnace

Pipette

50ml Volumetric flask

Hot plate

Crucible

Atomic Absorption Spectrophotometer(AAS)

3.1.2 CHEMICALS/REAGENT USED

Chemicals/reagent used for this research study includes:

Trioxonitrate(v)acid

Hydrogen peroxide

Distilled water

Ashed oha seed

Water

3.2 METHODOLOGY

3.2.1 The study Area

The experimental analysis of this research was carried out in the Laboratory Section of Department of Chemical Engineering, Caritas University, Emene with a temperature of about 35^0(95^0F)and a cloud broken at about 1400ft.Emene-Enugu experiences a wind of 4.6km/h South West and is located at Latitude 6.4833333^0 and Longitude 7.5666667^0.It is 2km away from Enugu city.(Http://www.goggles.com.).

3.2.2 Collection and Preparation of Plant Material

Fresh seeds of Pterocarpus mildbreadii(Oha)were obtained from the plant tree left for many years found within 'Udi'village in Enugu state. These seeds were dried at room temperature for a period of one month after which they were grounded to powder using the Grinder(Mill).

3.2.3 Extraction

A quantity of 1g of the seed powder was weighed out using the chemical balance and was ashed in a furnace at 600-800^{0}c.The ash was combined with nitric acid,hydrogen peroxide and distilled water while heating, to obtain a paste-like extract of the seed.

3.2.4 Preparation of Reagents for AAS

Nitric acid:

A quantity 50ml of distilled water was added to pipetted 50% of nitric acid.

3.3 ELEMENTAL ANALYSIS

Put your sample into a crucible and put it inside the furnace at 600-800^{0}c.

If it ashes(turns to ash),weigh 1g of the ash into a 100ml beaker.

Add 10ml 50%HNO_3.

Place it on a hot plate for 30minutes, after which you bring down and allow to cool.

Add 10ml of H_2O_2(Hydrogen peroxide).

Add 10ml of distilled water.

Take back to the hot plate until it changes color or acids boil off/stops boiling.

Transfer the whole content into a 50ml volumetric flask and make it up to the 50ml mark with distilled water.

Put it inside Atomic Absorption Spectrophotometer.

Adjust the wavelength for each element and note the reading/value on the screen.

That is the amount of the element present in the sample.

3.4 ATOMIC ABSORPTION SPECTROMETRY

Atomic Absorption Spectrometry (AAS) is a technique for measuring quantities of chemical elements present in environmental samples by measuring the absorbed radiation by the chemical element of interest. This is done by reading the spectra produced when the sample is excited by radiation. The atoms absorb ultraviolet or visible light and make transitions to higher energy levels. Atomic absorption methods measure the amount of energy in the form of photons of light that are absorbed by the sample. A detector measures the wavelengths of light transmitted

by the sample, and compares them to the wavelengths which originally passed through the sample. A signal processor then integrates the changes in wavelength absorbed, which appear in the readout as peaks of energy absorption at discrete wavelengths. The energy required for an electron to leave an atom is known as ionization energy and is specific to each chemical element. When an electron moves from one energy level to another within the atom, a photon is emitted with energy **E**. Atoms of an element emit a characteristic spectral line. Every atom has its own distinct pattern of wavelengths at which it will absorb energy, due to the unique configuration of electrons in its outer shell.

This enables the qualitative analysis of a sample. The concentration is calculated based on the Beer-Lambert law. Absorbance is directly proportional to the concentration of the analyte absorbed for the existing set of conditions. The concentration is usually determined from a calibration curve, obtained using standards of known concentration. However, applying the Beer-Lambert law directly in AAS is difficult due to: variations in atomization efficiency from the sample matrix, non-uniformity of concentration and path length of analyte atoms (in graphite furnace AA).

The chemical methods used are based on matter interactions, i.e. chemical reactions. For a long period of time these methods were essentially empirical, involving, in most cases, great experimental skills. In analytical chemistry, AAS is

a technique used mostly for determining the concentration of a particular metal element within a sample. AAS can be used to analyze the concentration of over 62 different metals in a solution.

Although AAS dates to the nineteenth century, the modern form of this technique was largely developed during the 1950s by Alan Walsh and a team of Australian chemists working at the CSIRO (Commonwealth Science and Industry Research Organization) Division of Chemical Physics in Melbourne, Australia. Typically, the technique makes use of a flame to atomize the sample, but other atomizers, such as a graphite furnace, are also used.

Three steps are involved in turning a liquid sample into an atomic gas:

1. Desolvation – the liquid solvent is evaporated, and the dry sample remains;

2. Vaporization – the solid sample vaporizes to a gas; and

3. Volatilization – the compounds that compose the sample are broken into free atoms.

To measure how much of a given element is present in a sample, one must first establish a basis for comparison using known quantities of that element to produce a calibration curve.

To generate this curve, a specific wavelength is selected, and the detector is set to measure only the energy transmitted at that wavelength. As the concentration of the target atom in the sample increases, the absorption will also increase

proportionally. A series of samples containing known concentrations of the compound of interest are analyzed, and the corresponding absorbance, which is the inverse percentage of light transmitted, is recorded.

The measured absorption at each concentration is then plotted, so that a straight line can then be drawn between the resulting points. From this line, the concentration of the substance under investigation is extrapolated from the substance's absorbance. The use of special light sources and the selection of specific wavelengths allow for the quantitative determination of individual components in a multielement mixture.

Basic principle

The selectivity in AAS is very important, since each element has a different set of energy and gives rise to very narrow absorption lines. Hence, the selection of the monochromator is vital to obtain a linear calibration curve (Beers' Law), the bandwidth of the absorbing species must be broader than that of the light source; which is difficult to achieve with ordinary monochromators. The monochromator is a very important part of an AA spectrometer because it is used to separate the thousands of lines generated by all of the elements in a sample.

Without a good monochromator, detection limits are severely compromised. A monochromator is used to select the specific wavelength of light that is absorbed by the sample and to exclude other wavelengths. The selection of the specific

wavelength of light allows for the determination of the specific element of interest when it is in the presence of other elements. The light selected by the monochromator is directed onto a detector, typically a photomultiplier tube, whose function is to convert the light signal into an electrical signal proportional to the light intensity. The challenge of requiring the bandwidth of the absorbing species to be broader than that of the light source is solved with radiation sources with very narrow lines. The instrument used for atomic absorption spectrometry can have either of two atomizers:

One attachment is a flame burner, which uses acetylene and air fuels. The second attachment consists of a graphite furnace that is used for trace metal analysis. (http//www.wikipedia.com).

CHAPTER FOUR

RESULTS

S/N	METAL	ABBREVIATION	VALUE(mg/L)=(ppm)
1	Iron	Fe	0.376
2	Magnesium	Mg	0.193
3	Calcium	Ca	0.558
4	Zinc	Zn	0.020
5	Copper	Cu	0.014
6	Manganese	Mn	-nil
7	Sodium	Na	0.880
8	Potassium	K	19.180
9	Selenium	Sc	0.022

CHAPTER FIVE

DISCUSSION.

Elemental analysis was carried out on grounded Oha seed extract(Pterocarpus mildbreadii [Harms]) using Atomic Absorption Spectrophotometer(AAS MODEL-AA320N).This method has been used widely as a working model of analysis in the search for content of various plant seeds(http//www.intechopen.com).The elements present in the seed are iron-0.376mg,magnesium-0.193mg,calcium-0.558,zinc-0.020,copper-0.014,sodium-0.880,potassium-19.180,selenium-0.022,manganese-nil.

The human system is a mixture of thousands of compounds that are constantly being used and replaced by chemical reactions. These compounds are either obtained directly from food sources or are formed by chemical reactions from compounds in foods. The body contains 60% of water(40%intracellular fluid;20%extracellular fluid).Another fraction of the body are characterized as major/macro minerals. Macro elements/minerals(K,Na,Mg,Ca,P,N,C,O,H) are present in all cells of the body, maintaining general homeostasis and required for normal functioning.

Trace or micro minerals/elements(Fe,Mn,Mo,Co,Se,I,Co,Cr,Br,Si,V,F) contribute to good health(or growth for plants and animals)if they originate from an organic

source because they have essentially been processed. Trace minerals are present in quantity barely large enough to fill easpoon. However, each of them plays a vital role in maintaining life, having a function for which there is no substitute. In many cases not only deficiency but also an excess would be fatal. Metals (and its organic and inorganic complexes) are employed by all types of organisms, and are critical for life functions. They mediate crucial processes that include: energy storage, regulation and processing of DNA and RNA, biosynthesis,detoxification,intra and intercellular transport even signaling events.(Bio Info Bank Institute 2013).

Many elements function in biological systems as a simple ions that play essential roles in about one-third of the enzymes. These ions can modify electron flow in a substrate or enzyme thus effectively controlling an enzyme-catalysed reaction. They can serve to bind and orient substrate with respect to functional groups in the active site, and they can provide a site for redox activity if the metal has several valence states. Without the appropriate metal ion, a biochemical reaction catalyzed by a particular metalloenzyme would proceed very slowly, if at all. Other elements function with protein complexes or cofactors (Eitner 2013).

Bulk Metal Biological functions

Na^+ & K^+

*As electrolytes.

*Maintain the concentration gradient in living cells(osmotic balance).

*Helps in active and passive transport.

*Charge carriers.

Mg^{2+}

*Present in chlorophyll and helps in photosynthesis.

*In energy production(ATP---ADP);

*Activation of enzymes.

*Information carrier.

*Present in exo and endo skeletons.

Ca^{2+}

*Charge carrier.

*In muscle and nerve functions-cell signaling.

*It acts as second messenger and sentinel at synapse.

*Present in teeth as $Ca_5(PO_4)_3(OH)$ (hydroxylapatite).

*$CaCO_3$ is present in endo and exoskeletons.

*In activation of enzymes.

*In blood coagulation.

Trace Metal Biological functions

Zn^{2+}

*Hydrolytic enzymes: carboxypeptidase

*Metal storage:eg.,metallothionein.

*Zinc finger proteins(genetic transcription),stabilization of proteins.

$Cu^{I/II}$

*Electron transfer.

*Transport and storage of dioxygen.

$Fe^{II/III}$

*Found in hemoglobin and myoglobin, two of the oxygen needed for life processes.

*Electron transfer.

*Fe_3O_4 is used to store iron, and, as it is magnetic, is used by magnetotactic bacteria to sense the direction of the Earth's magnetic field.

*Cobalamine(eg.Vitamin-B_{12})

*Conversion of N2 to ammonia(nitrogen fixation).

$Mn^{II/III/IV}$

*Electron transfer.

In photosynthesis, generation of dioxygen by splitting water. It is part of OEC(Oxygen Evolving Complex)in PS-II system.

$Se^{(II)}$

*Selenocysteine.

CONCLUSION

Elemental analysis which defines the qualitative and quantitative determination of chemical elements was applied on Pterocarpus mildbreadii(Oha seed)extract which demonstrated minor as well as macro minerals(potassium K, sodium Na, calcium Ca, magnesium Mg, iron Fe, copper Cu, zinc Zn, manganese Mn, and Selenium Se).The obtained results thus, provide a support for the use of the plant by humans and suggest more investigation into the reactivity of the plant. The mineral value of the plant seed was obtained after it was grounded and turned to paste(R.W.J et.al.,1964).

Investigation into the acute toxicity level and anti-inflammatory activity of the seed can be helpful too.

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